



**FIXED PRICE
RESEARCH & DEVELOPMENT CONTRACT**

Contract No.: Specimen (08/04/2003)

BETWEEN

**CALIFORNIA INSTITUTE OF TECHNOLOGY
JET PROPULSION LABORATORY
(The "Institute" or "JPL")
4800 OAK GROVE DRIVE
PASADENA, CALIFORNIA 91109-8099**

AND

**Contractor's Name
Address
City, State, Zip**

**THIS CONTRACT FOR
CONCEPT DESIGN STUDY FOR:**

**TERRESTRIAL PLANET FINDER (TPF)
HIGH CONTRAST IMAGING TESTBED (HCIT)
TELESCOPE FRONT END (TFE)**

**IS A
SUBCONTRACT UNDER JPL's NASA PRIME CONTRACT**

TASK ORDER NO. 10284

A DO - C9 Rating is assigned to this Contract under DMS Regulation 1

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The following documents are incorporated into and made a material part of this contract.

GENERAL PROVISIONS: Fixed-Price Research and Development Contract R 8/03, with Included Exhibits:

“Release of Information” R 9/99 - JPL 1737

“Notification to Prospective Contractors of JPL's Ethics Policies and Anti-Kickback Hotline” R 7/91 - JPL 2385

“Certifications” R 8/01 - JPL 2892

“Asbestos Notification” R 9/98 - JPL 2895

“Notice of Potential Tax Withholding”, R 7/03

ADDITIONAL GENERAL PROVISIONS (AGPs)

New Technology (8/01) (Large companies)

or

Patent Rights – Retention By The Contractor (Short Form) R 4/99 (Small Companies)

Prime Contract Expiration – Fixed Price (03/03)

PREAMBLE

This Contract, entered into on _____ by and between the CALIFORNIA INSTITUTE OF TECHNOLOGY (hereinafter called the "Institute" or "JPL"), a corporation organized and existing under the laws of the State of California, and (NAME OF CONTRACTOR GOES HERE) (hereinafter called the "Contractor"), a corporation organized and existing under the laws of the State of XXXX and constituting a subcontract under prime contract with NASA;

WITNESSETH THAT:

The Contractor agrees to furnish and deliver the supplies and perform the services set forth in this Contract for the consideration stated herein.

ARTICLE 1. STATEMENT OF WORK AND DELIVERY INSTRUCTIONS

1.0 The Contractor shall conduct a design study that defines the requirements, functionality, interfaces and system design concept for a telescope front-end (TFE) that will be integrated to the High Contrast Imaging Testbed (HCIT). The HCIT is JPL's existing vacuum test facility that is being used to validate high contrast imaging technologies and methodologies. The TFE will be installed in this facility.

In the performance of this Pre-phase A study effort, the Contractor shall:

- 1.1 Define and document the requirements for a TFE that includes features to enhance the HCIT ability to simulate through testing the on-orbit performance of a Terrestrial Planet Finder (TPF) coronagraph. Features shall be defined and described, and may include, but are not limited to:
 - 1.1.1 The ability to provide a hardware simulation of a relevant TPF telescope and its optical, mechanical and thermal performance, as well as relevant disturbances.
 - 1.1.2 An optical beam of sufficient quality at the telescope exit interface to attain 10^{-10} contrast in conjunction with the HCIT testbed, working over the wavelength range of 550 to 950 nanometers, at inner working angles less than $4\lambda/D$, and ideally as small as λ/D .
 - 1.1.3 A Star Field and Planet Simulator that includes provisions for simulation of F (7,400K), K (4,000K), and G (6,000K) stars and their representative planets.
- 1.2 Develop and document the TFE design concept including, as a minimum, the following:
 - 1.2.1 The ability to simulate telescope optical, thermal, and mechanical performance, sensitivities, and relevant disturbances.
 - 1.2.2 Interfaces and performance consistent with the TPF HCIT and TPF requirements as provided in Exhibit I through Exhibit V.
- 1.3 Define tests and test instrumentation that may be performed with the proposed TFE, the features that enable each test, and the benefits to the HCIT and TPF that will be derived from those tests.
- 1.4 Develop and document an implementation plan, including cost and schedule, for the TFE hardware, its software, and its proposed features. Document each proposed feature's development cost and schedule separately. Define any feature interdependencies.
- 1.5 Develop and document an integration plan to integrate the TFE with the JPL HCIT.
- 1.6 Define all TFE development risk items and contingency strategies to mitigate those risks.
- 1.7 Contract Deliverables
 - 1.7.1 Prepare and submit monthly status reports that contain:

- 1.7.1.1 Technical progress.
- 1.7.1.2 Schedule status.
- 1.7.1.3 Issues, problems, and proposed solutions.
- 1.7.2 Prepare and submit a TFE final written report that stands alone without oral presentation (e.g. prose or annotated Powerpoint) and contains:
 - 1.7.2.1 The TFE design concept including each feature and its tests, function, requirements, and interdependency of each feature with other features.
 - 1.7.2.2 The TFE requirements, error budget allocations, assumptions and models (Computer Aided Design-CAD), optical, stray light, thermal and Finite Element Models (FEM), and associated simulations and materials lists.
 - 1.7.2.3 Description of the TFE mechanical, optical, software, electrical, and modeling interfaces with the HCIT and the integration plan.
 - 1.7.2.4 Description of the TFE functionality , capability, operation, inputs, and expected outputs including test and instrumentation plan.
 - 1.7.2.5 The TFE work breakdown structure (WBS), schedule and milestones, estimated cost (allocated to TFE and each feature down to WBS level 2), reviews and all assumptions used in developing cost estimates.
 - 1.7.2.6 Prioritized list of the offeror's top concerns related to the TFE design and proposed mitigation approach.
 - 1.7.2.7 Detailed description, including scope, conditions, required facilities and schedule, of any proposed collaboration with JPL and NASA during the Development Phase.
- 1.8 Program Reviews
 - 1.8.1 Attend a Kick-off meeting to be held at JPL and open to TPF science and engineering communities. Receive feedback on JPL's HCIT technology plans, introduce key personnel and discuss planning for the Contract.
 - 1.8.2 Participate in a weekly teleconference with JPL Contract Technical Manager (CTM) and Cognizant Engineer (CogE) to discuss status, issues, and any concerns.
 - 1.8.3 Prepare and present a Mid-Term Review at the Contractor's facility covering all aspects related to the TFE and its features. Topics include progress on:

- 1.8.3.1 The TFE design concept including each feature and its tests, function, requirements, and interdependency of each feature with other features.
- 1.8.3.2 The TFE requirements, error budget allocations, assumptions and models (Computer Aided Design (CAD), optical, stray light, thermal and Finite Element Models (FEM), and associated simulations and materials lists.
- 1.8.3.3 Description of the TFE mechanical, optical, software, electrical, and modeling interfaces with the HCIT and the integration plan.
- 1.8.3.4 Description of the TFE functionality , capability, operation, inputs, and expected outputs including test and instrumentation plan.
- 1.8.3.5 The TFE work breakdown structure (WBS), schedule and milestones, estimated cost (allocated to TFE and each feature down to WBS level 3), reviews and all assumptions used in developing cost estimates.
- 1.8.3.6 Prioritized list of the offerer's top concerns related to the TFE design and proposed mitigation approach.
- 1.8.3.7 Detailed description, including scope, conditions, required facilities and schedule, of any proposed collaboration with JPL and NASA during the Development Phase.
- 1.8.4 Preliminary Design Review (PDR) - Prepare and conduct a presentation at the contractors facility covering the telescope front-end system and features design and development plans. Topics include, but are not limited to, the following:
 - 1.8.4.1 The TFE design concept including each feature and its tests, function, requirements, and interdependency of each feature with other features.
 - 1.8.4.2 The TFE requirements, error budget allocations, assumptions and models (Computer Aided Design (CAD), optical, stray light, thermal and Finite Element Models (FEM), and associated simulations and materials lists.
 - 1.8.4.3 Description of the TFE mechanical, optical, software, electrical, and modeling interfaces with the HCIT and the integration plan.
 - 1.8.4.4 Description of the TFE functionality , capability, operation, inputs, and expected outputs including test and instrumentation plan.
 - 1.8.4.5 The TFE work breakdown structure (WBS), schedule and milestones, estimated cost (allocated to TFE and each feature down to WBS level 3), reviews and all assumptions used in developing cost estimates.

- 1.8.4.6 Prioritized list of the offerer's top concerns related to the TFE design and proposed mitigation approach.
- 1.8.4.7 Detailed description, including scope, conditions, required facilities and schedule, of any proposed collaboration with JPL and NASA during the Development Phase.

2.0 JPL will

- 2.1 Lead the TPF management and technical teams.
- 2.2 Conduct a Kick-off Meeting in which current testbed technology at JPL will be presented for contractor information and discussion.
- 2.3 Review monthly reports and provide comments, if any, within 2 weeks.
- 2.4 Assemble reviewers and attend the Mid-Term Review.
- 2.5 Assemble reviewers and attend the Preliminary Design Review.
- 2.6 Provide technical, management, and cost proposal instructions and proposal evaluation criterion for the Implementation Phase.

3.0 Exhibits

- 3.1 Incorporated Exhibits - The following Exhibits are incorporated into and hereby made a part of this Contract:
 - 3.1.1 Exhibit I, HCIT System Layout, dated 7/24/2003.
 - 3.1.2 Exhibit II, HCIT Optical Prescription, dated 7/24/2003.
 - 3.1.3 Exhibit III, HCIT Vacuum Chamber Interface Drawing, dated 7/24/2003.
 - 3.1.4 Exhibit IV, TFE Preliminary Guidelines Table, dated 7/29/2003.
 - 3.1.5 Exhibit V, HCIT Optical Input Coordinate system, dated 7/25/2003.
 - 3.1.6 Exhibit VI, Preliminary Surface Figure Requirements for Primary Mirror, dated 7/29/2003.
 - 3.1.7 Exhibit VII, TFE Implementation Phase Draft Statement of Work, dated 7/29/2003.
- 3.2 Unincorporated Exhibits – The following Exhibits are for information only:
 - 3.2.1 <http://planetquest.jpl.nasa.gov/TPF/TPFrevue/FinlReps/JPL/tpfrpt1a.pdf> for JPL Architecture Study Summary Report.
 - 3.2.2 <http://planetquest.jpl.nasa.gov/TPF/index.html> for reports from architecture studies (2000-2002).

- 3.2.3 http://planetquest.jpl.nasa.gov/Navigator/library/TechPlan_4-4-03RevA.pdf for the TPF Technology Plan.

4.0 Delivery Instructions & Schedule

- 4.1 Except as otherwise provided in this Contract, the point of inspection, acceptance and delivery of all supplies deliverable under this Contract shall be the Jet Propulsion Laboratory, 4800 Oak Grove Drive, Pasadena, California 91109. All such supplies shall be packaged, packed, boxed, or crated in such a manner to ensure safe delivery and shall be shipped prepaid and at the Contractor's expense to the point of delivery.
- 4.2 Time is of the essence in the performance of this Contract.
- 4.3 The Contractor shall furnish the Contracting Officer (CO) with the annual and final reports of reportable items described in the Article entitled "New Technology." Copies of transmittal letters for those reports shall be sent to the JPL Intellectual Property Office (IPO) and to the cognizant JPL negotiator.
- 4.4 The Contractor shall furnish and deliver the supplies and perform the services required by ARTICLE 1, STATEMENT OF WORK, in accordance with the following schedule:

DELIVERABLES	SCHEDULE (*)	SOW Reference
Kick-off Meeting	1 week ADC	1.8.1
Weekly Status Teleconference	Each Friday	1.8.2
Monthly Report	Every month by the 10th	1.7.1
Mid-Term Review	4 months ADC	1.8.3
Preliminary Design Review	7 1/2 months ADC	1.8.4
Final Report & Implementation Phase Proposal	8 months ADC	1.7.2

* ADC - After Date of Contract

(end of Article 1)

ARTICLE 2. PRICE AND PAYMENT

1.0 Total Fixed Price: \$200,000.00

2.0 Minimum Level of Effort

The Contractor agrees to supply, at a minimum, (TBD) hours of Engineering effort in the performance of the tasks defined in Article 1. STATEMENT OF WORK and to maintain adequate records to show the hours expended. If after receipt of the deliverables defined in Article 1, paragraph 4.0. Delivery Instructions and Schedule it is JPL's judgment that the Contractor may have supplied less than , (TBD) hours the Contractor shall be required to disclose the actual Engineering hours applied to the tasks defined in Article 1. If after JPL's examination of the Contractor's records the number of Engineering hours is less than , (TBD) hours the contractor shall either be required to expend additional Engineering hours up to , (TBD) hours in order to supply JPL with acceptable study deliverables; or reduce the total fixed price of the contract. The Contractor shall not be entitled to an equitable adjustment should the expended Engineering hours exceed the minimum.

3.0 Invoices. Invoices shall be submitted, in triplicate, to JPL Supplier Payment Section, M/S 601-208, 4800 Oak Grove Drive, Pasadena, California 91109.

(end of Article 2)

ARTICLE 3. LIMITATION OF JPL's OBLIGATION

- 1.0 The Firm Fixed Price of this Contract is the amount set forth in paragraph 1.0 of ARTICLE 2, PRICE AND PAYMENT, subject to the limitations set forth in this Article.
- 2.0 Subject to paragraph 6.0 below, the amount set forth in Period No. 1 of the following Incremental Liability Schedule reflects the maximum limitation of the Institute's liability for all purposes, including incurred costs, termination costs (including amounts payable with respect to subcontracts and settlement costs) and allowance for profit or fee:

INCREMENTAL LIABILITY SCHEDULE

<u>Period No.</u>	<u>Cumulative Maximum Liability</u>	<u>Terminal Date</u>
1	\$TBD	TBD
2	\$TBD	TBD

- 3.0 It is anticipated that JPL shall, prior to the terminal date, if any, of the Period specified in the first line of paragraph 2.0 above, issue a Unilateral Modification to revise the maximum limitation to the amount set forth in the next successive period. The determination as to whether to issue such a modification shall be at JPL's sole discretion. In the event that JPL does not issue such a modification prior to the terminal date, this Contract shall, unless the Contractor requests a terminal date extension in writing prior to the terminal date, be deemed terminated for convenience and the Contractor shall proceed as if the Contractor has received a Notice of Termination pursuant to the GP Article entitled "Termination for Convenience." JPL shall, upon receipt of a written request from the Contractor for Terminal Date extension, immediately issue a unilateral modification extending the Terminal Date in accordance with Contractor's request. If the Contractor or JPL have reason to believe that any other change in the Incremental Liability Schedule would be in the best interest of the contract effort, the Contractor or JPL may notify the other party in writing to that effect, together with the requested change. If the Contractor and JPL agree with the requested change, the Incremental Liability Schedule will be revised by Supplemental Agreement to the Contract.
- 4.0 In the event that JPL issues such a UM to increase the liability after the terminal date, the Contract shall no longer be deemed terminated, and such UM shall have the same effect as if it had been issued prior to the terminal date; provided however, that if JPL's failure to issue the UM by the terminal date caused an increase of the cost of, or the time required for, performing this Contract, because the Contractor proceeded as if a Notice of Termination had been issued, an equitable adjustment shall be made in (i) the Contract Price, the time of performance, or both; and (ii) other affected terms of the Contract. The Contractor must assert its right to such equitable adjustment within 30 days of receipt of the UM. However, if JPL decides that the facts justify it, JPL may receive and act upon a proposal submitted before final payment of the Contract. Subject to paragraph 6.0 below, in the event that this Contract is terminated pursuant to this Article, or otherwise terminated by JPL pursuant to the GP Article entitled "Termination for Convenience," the cumulative liability amount set forth in the Incremental Liability Schedule for the Period referenced in the first sentence of paragraph 2.0 of this Article, reflects JPL's maximum liability notwithstanding anything to the contrary in the GP Article entitled "Termination for Convenience," or the value of supplies and services delivered to and retained by JPL.
- 5.0 The Contractor has used the Incremental Liability Schedule to plan its progress payments, partial payments, obligations and termination liability. It is a management prerogative of the Contractor to determine if any part of these elements are to be under funded or at risk (relative to the Incremental Liability Schedule) for any period of time. This is a firm fixed price type Contract. The Contractor assumes all risk for any variance between planned and actual costs, including planned and actual termination liability. The Contractor is strictly liable for all cost variances, including cost variances attributable to indirect rate changes and shall in no event be excused from the obligation to complete performance in accordance with the price, delivery schedule, and

technical requirements of this Contract.

- 6.0 If the Contract is modified, the provisions of this Article shall not limit the Contractor's obligation pursuant to GP Article entitled "Changes," to diligently pursue the performance of the Contract as modified. In the event that a unilateral modification contains a liability limit for work performed under such modification, the Contractor's obligation to pursue performance of such modification and the Institute's liability for such modification, shall, until the UM(s) is bilaterally settled, be limited by the amount of the liability limit included in the UM. Until such a UM is settled, the liability limit on the UM does not increase the baseline liability in paragraph 2.0. In the event that this Contract is deemed terminated pursuant to paragraph 3.0 of this Article or the GP Article entitled "Termination for Convenience," prior to the settlement of an outstanding UM(s), the Institute's maximum liability for all purposes, including incurred costs, termination costs (including amounts payable with respect to subcontracts and settlement costs and consideration for delivered supplies and services) and allowance for profit or fee, shall be no more than the sum of the cumulative liability amount set forth in the Incremental Liability Schedule for the Period referenced in the first sentence of paragraph 2.0 of this Article, plus the liability limit(s) set forth in the UM(s).
- 7.0 Unilateral Modification Liability Limits.
- 7.1 Reserved.
- 7.2 Reserved.
- 8.0 In the event that this Contract contains a provision providing for progress payments, such provision shall be subject to the limitations set forth in this Article and the "contract amount" referred to in any such provision for progress payments is the Firm Fixed Price of this Contract set forth in paragraph 1.0 of ARTICLE 2, PRICE AND PAYMENT.
- 9.0 The provisions of this Article shall in no way limit the Institute's rights under the GP Article entitled Default.

(End of Article 3)

ARTICLE 4. SPECIAL PROVISIONS

1.0 Key Personnel/Facilities

The personnel and/or facilities, if any, specified below in paragraph 1.1 are considered essential to the work being performed hereunder. Prior to removing, replacing, or diverting any of the specified individuals or facilities, the Contractor shall notify JPL reasonably in advance and shall submit justification (including proposed substitutions) in sufficient detail to permit evaluation of the impact on this Contract. No diversion shall be made by the Contractor without the written consent of JPL; provided, that JPL may ratify in writing the change, and such ratification shall constitute the consent of JPL required by this Article. Paragraph 1.1 below may, with the consent of the Contracting parties, be amended from time to time during the course of the Contract to either add or delete personnel and/or facilities, as appropriate.

The following Contractor personnel shall be considered Key Personnel under this Contract:

1.1 TBD

(end of Article 4)

IN WITNESS WHEREOF, the parties hereto have executed this Contract as of the day and year first above written.

CALIFORNIA INSTITUTE OF TECHNOLOGY

By _____
(Signature)

(Typed Name)

(Title)

CONTRACTOR NAME GOES HERE

By _____
(Signature)

(Typed Name)

(Title)

Instructions to Contractor: Do not insert date on Preamble page.